

We claim:

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- 5 1. An integrated circuit probe card inspection system for determining the relative location of probes in a probe array, comprising:  
a viewing system providing an image of the tip of each probe in digital form,  
a window with a flat surface contacted by said probe tip,  
a computer means with software means to analyze the probe image position within the video image, and  
positioning means to position the center of the digital image to a known physical position with said probe contact in the field of view.
- 10 2. An integrated circuit probe card inspection system according to claim 1, wherein said viewing system comprises a charge-coupled device (CCD) video camera and computer compatible image capture board.
3. An integrated circuit probe card inspection system according to claim 1, wherein said window is of sapphire material.
- 15 4. An integrated circuit probe card inspection system according to claim 1, wherein said positioning means includes X, Y, and Z position controls.
5. An integrated circuit probe card inspection system according to claim 1, wherein said software means comprises programs for implementing blob analysis.
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- 20 6. An integrated circuit probe card inspection system for determining the location and length of the scrub mark which would be made by a probe tip on an integrated circuit bonding pad, comprising:  
a viewing system providing an image of the probe tip in digital form,  
a window with a flat surface contacted by said probe tip,  
a computer means with software means to analyze the probe tip image position  
25 within the video image, and
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positioning means to position the center of the digital image to a known physical position with said probe tip in the field of view.

7. A method for determining the location and length of the scrub mark made by a probe on an integrated circuit bonding pad contacted by the probe, said method comprising the steps of:

capturing a first digitized image at a first defined overdrive, and  
capturing a second digitized image at a second defined overdrive, then  
determining the path and form of the scrub mark from the position and size of the two digitized images.

8. An apparatus for determining the length of a probe tip, comprising:  
contacting means for sequentially contacting the tip and the beam of a spring contact probe,  
positioning means for controlling X,Y and Z axis movements of said contacting means,  
measuring means for determining the angle of the scrub mark created by the probe tip upon contact and overdrive against a surface,  
measuring means for determining the position of the beam portion of the probe from the position of the tip and the angle of the scrub mark,  
measuring means for determining the vertical height of each contacted point from a known reference, and  
calculating means for determining the difference in the two measured heights representing the length of the probe tip.

9. A method for learning the probe tip locations of an existing known good probe card by:  
capturing a digitized image of each probe tip on the probe card, then  
determining the relative position of each probe tip with respect to the other probe tips on the probe card, then  
constructing a file of said relative position information for use in determining the correct placement of probe tips on other probe cards of the same type.

10. A method for determining the orientation and spatial position of an array of probes with respect to the test apparatus for determining probe position by:  
positioning the video microscope field of view within the array of probes, and  
moving in a known direction along the X or Y axis a distance not exceeding the  
5 X or Y dimension of the chip corresponding to the probe card, and  
checking for probes in the field of view, and  
if no probes are found along the original axis selected, moving along the opposite  
direction of that axis and along the positive and negative directions of the other axis, no  
more than the dimension of the chip in that axis, until probes are found, and  
10 digitizing the image of any probe tips found by the video microscope, and  
determining by electrical means which probe of the array is being viewed by the  
video microscope, and  
comparing the information thus obtained to the X,Y probe locations of the probe  
array to determine the orientation of the probe array with respect to the X and Y axes and  
15 the location of at least one probe in the array.

11. A method for sanding probe tips to a known extent by:  
determining the vertical height of at least the lowest probe of an array of probes  
by making contact with a planar metallic surface, and  
moving the array of probes over a metallic surface sanding area which is co-planar  
20 with said planar metallic surface, and  
moving said metallic surface sanding area until electrical contact is made with the  
lowest probe in the array, and  
further moving said metallic surface sanding area into physical and electrical  
contact with said array of probes to a known amount desired to provide proper sanding.

25 12. Means for determining the relative locations of bonding pads of an integrated circuit chip, comprising, in combination:  
a photomask of the passivation layer of said integrated circuit,  
a viewing system providing an image of each bonding pad area of said photomask  
in digital form,

holding means to position said photomask in a known orientation to the viewing system,

lighting means to enhance contrast between clear and dark areas of said photomask,

5 computer means with software means to analyze said bonding pad image position within the video image, and

positioning means to position the center of the digital image to a known physical position with each of said bonding pads sequentially in the field of view.

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